(12) UK Patent Application (19) GB (11) 2 374 625 (13) A

(43) Date of A Publication 23.10.2002

(21) Application No 0205570.5

(22) Date of Filing 11.03.2002

(30) Priority Data
(31) 0105998 (32) 10.03.2001 (33) GB
(31) 0201195 (32) 19.01.2002

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(51) INT CL[7]
E04B 2/00 , E02B 3/12 , F42D 5/045

(52) UK CL (Edition T)
E1H HJA
A5A A23 A37
E1D DGS2 DLEQW2 D2019 D2038 D2131 D401 D428
F3C CPK

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(58) Field of Search
UK CL (Edition T) A5A A23 A37 , E1D DF115 , E1H HJA , F3C CPK
INT CL[7] E02B 3/12 , E04B 2/00 , F42D 5/045
EPODOC WPI JAPIO

(54) Abstract Title
Blast protection fluid filled bags

(57) A blast protection structure is formed from rupturable flexible bag containers (1) which have an aperture and a filler cap so that fluid can be introduced into the bag (1) thereby imparting rigidity to the bag (1). The bags (1) may be formed from upper and lower compartments with the lower compartment having a reinforcing layer (2). The upper surface (3) of the upper compartment may have a non-slip coating to facilitate stacking of the bags (1). The bags (1) may be stacked into a blast protection structure (fig 3) or may be used to form a pathway over which vehicles may travel.

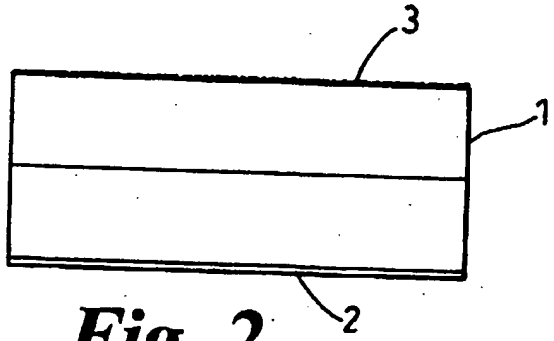

Fig. 2

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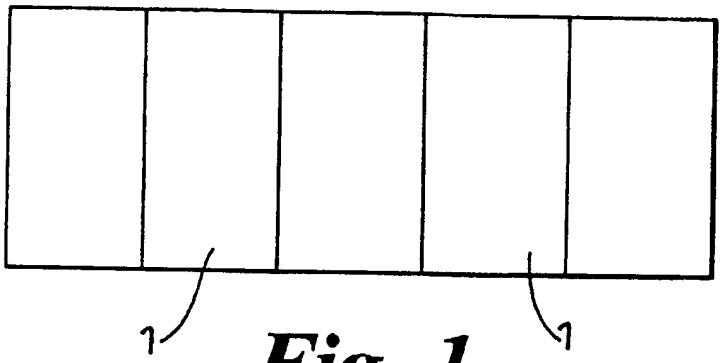

Fig. 1

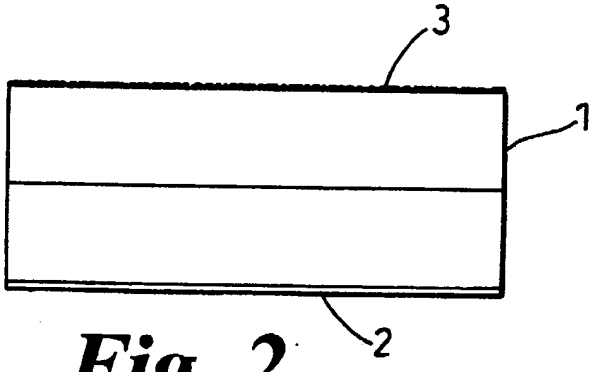

Fig. 2

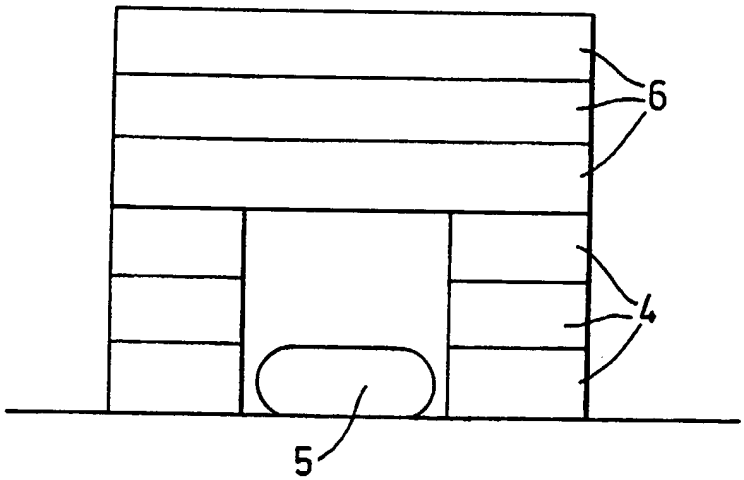

Fig. 3

Blast Protection Structures

This invention relates to blast protection structures and in particular to bags used to make blast protection walls and roadways.

A classic temporary blast protection wall is made of sandbags. Although sandbags are of proven value, they do have drawbacks. They are time consuming and not that easy to fill. They generally have to be filled at least a short distance away from where the wall is to be built, and hence have to be carried there after filling. Further, a suitable filling material is not always readily available, and once the need for the wall is over, emptying the bags and disposing of the filling material can be as problematic as filling them and building the wall in the first place.

An alternative that has been in more recent use, comprises tanks of water, built up like bricks. The tanks are generally of black or at least dark plastics material and are substantially rigid. They are fairly light when empty, and so courses of tanks can easily be placed one adjacent another to form a wall, and then filled in situ from a hose, using either a local water supply or a tanker. But they are bulky items to store and transport, and they cannot readily be made to nest together in a compact stack. They have to be closed vessels. Also, being opaque, they cannot be checked at a glance to see whether they are full or empty.

It is an object of the present invention to overcome, or at least ameliorate these disadvantages.

According to the present invention, there is provided a blast protection structure comprising one or more rupturable containers, each of said rupturable containers being formed of a flexible bag having a aperture and filler cap so that fluid can be introduced into the bag and sealed therein, to give substantial rigidity to said rupturable container and to provide blast protection.

It is envisaged, that the fluid may be a combination of water and air, introduced sequentially into the bag. It is preferred that the bags should be completely water filled, since if there is an explosion, the water will be a far more effective suppressant than air. However there may be occasions when water is insufficient in quantity or is even not available, but there is a compressor available.

For some purposes, the blast protection structure may have bags which are divided into internal chambers, preferably one above the other with the lowermost chamber having a reinforcement layer.

It is envisaged the bag may be divided into two chambers, with the reinforcement layer being Kevlar ®.

Preferably the uppermost chamber of the bag has an external non-slip coating. This coating may be integral with the material making up the bag or it may be a non-slip layer which is applied to the bag after manufacture. The non-slip coating reduces the risk of adjacent bags from

moving relative to one another, so weakening the structure.

It is preferred that the flexible bags have tongues and grooves or rebates to enable adjacent flexible bags to be interlocked or to have some degree of interengagement. Further, the bags, which will generally be of already referred to reinforcement plastics material, may be fabric reinforced throughout, and they can be constructed with internal webs or ties so that when in position they approximate a solid block and not bulge excessively.

Ideally it is envisaged that the flexible bags will be formed of a drop stitch material, which comprises two parallel skins interconnected by a dense uniform "forest" of equal length filaments so that if the skins are urged apart (as when they form opposite sides of a bag filled with water) they remain flat and parallel rather than bulging. This provides a degree of uniformity at opposed faces and so allows for easier construction of the structure using the bags.

Further it is envisaged that a blast protection structure may be formed whereby the flexible bags are used in conjunction with rigid containers to provide blast protection. Provision may be made for the bags to leave gaps for access by cameras or robotic arms, or even by human hands. These gaps do not have to be very large and measures can be taken to mitigate the effect of any blast escaping through them. An example of such measures could be the inclusion of meshing.

One type of blast protection structure is formed by flexible bags which are assembled in layers. It may be a simple wall, or a more complex arrangement such as a plurality of sealable bags assembled into a hood-like structure which is enlarged and stablised by the bags being filled with liquid.

Bags arranged in layers will generally be filled from the bottom layer upwards. In a simple form, a dome is created, which can be quickly assembled over a suspect package or container, for example, and when complete any explosions should be largely or even completely contained within the dome. The bags may suffer irreparable damage and the surrounding areas may be flooded in a limited way, but this is not as life threatening as an explosion. Further, the release of liquid would help to extinguish any flames or fire that is produced or suppress any smoke and it is the density of liquid that allows for such actions.

It is further envisaged that a blast protection structure may be formed by filled bags linked to one another to form a linear structure. Preferably, the linear structure forms a pathway over which persons or vehicles may travel.

Such a structure may provide a temporary path or roadway for laying over hazardous ground. It comprises a plurality of sealable bags linked to be capable of being rolled out or distributed from a bundle into a interim path or roadway, this being completed by filling the bags with

fluid.

Thus, when confronted with a mine field, a bundle of these bags can be unrolled in front of the user, or attached one by one in sequence to a growing path or roadway, the bags being successively filled to make them semi-rigid before any substantial weight is imposed on them. Concentrated load on the upper surface will be dissipated into a low unit area pressure on the ground and absorbed or imparted to the surrounding ground by the lower under surface. For example, a foot fall that would set off a personnel mine if there was direct contact has its effect spread so that there is not sufficient pressure on the mine, if beneath the path, for it to be detonated. On a larger scale, the wheels of a truck would not set off a vehicle mine beneath a load spreading roadway. Also, of course in the case of air-filled bags, buoyancy provided by the air-filled bags would serve better if swampy ground is to be traversed.

In building blast protection structures according to the invention, whether they be for a dome structure, wall or a linear structure forming a roadway, a course of empty bags can be laid out, filled in situ, followed by another course of empty bags and so on.

When no longer needed each bag can be emptied simply by pulling a plug, and once emptied the bags can be rolled or folded into compact form for transport and storage.

Apart from filler caps and drain plugs, there need be

no rigid parts so that, in the event of a blast, there is initially no hazard from flying shards of metal or substantially rigid plastics material.

Should any bag be punctured and leak, this will be soon, if not immediately, apparent from a sag in the wall and a visible trickle or spurt of water, and remedial action can be taken.

For a better understanding of the invention some embodiments will now be described, by way of example. With reference to the accompanying drawings, in which:

Figure 1 is a plan view of a temporary path constructed from water-filled bags;

Figure 2 is a cross-section of one such bag; and

Figure 3 is a cross-section of a protective shield.

The path of Figure 1 is made up from a plurality of elongate watertight bags 1, transverse to the direction of the path. When empty they can be rolled up, and when rolled out flat they can be filled with water sequentially so that each bag becomes hard, but not absolutely rigid. They are preferably made of drop-stitch material, as mentioned above, so that the path is generally flat.

Each bag is double chambered, one above the other as shown in Figure 2. The underside 2 is sheathed in the material known as Kevlar, as protection against rough surfaces and for blast mitigation. The upper surface 3 has a non-slip coating or layer applied to it. Typically the total depth might be of the order of 200mm (each chamber

100mm) and the dimension in the longitudinal direction of the path 1.45m. The width can be selected as desired.

In Figure 3, a set of annular bags 4 can be built up into a drum-like wall to surround a device 5 that might explode. This wall is capped by several disc-like bags 6, roofing over the device 4.

In the wall construction, empty bags are placed in position before being filled and they can be constructed with internal ties so that they do not bulge, but form flat topped pillars, which can lie in stable courses, one above the other.

The bags are filled sequentially from the bottom, and when the structure is complete there is quite a mass of contained water over the device, and thick walls of compressed water bags around it. An explosion will be largely if not completely contained.

If a blast is thought to be imminent and if no protection exists, this waterbag protection can often be put in place and erected without a person approaching the blast source, such as a suspected parcel bomb. Empty pre-linked bags can be carried robotically into proximity of the blast source trailing pre-connected hoses. The bags can be filled from a distance, building up a protective structure in front of, or even around and over, the danger point.

Although the main embodiments of the invention relate to dome and roadway structures, other structures may be

formed from the flexible bags such as bunkers, tunnels or reinforcing walls, placed in front of windows or doors of doorways.

Claims

1. A blast protection structure comprising one or more rupturable containers, each of said rupturable containers being formed of a flexible bag having an aperture and filler cap so that fluid can be introduced into the bag and sealed therein to give substantial rigidity to said rupturable containers and to provide blast protection.

2. A blast protection structure according to Claim 1, wherein the fluid introduced is water.

3. A blast protection structure according to Claim 1, wherein the fluid is a combination of water and air, introduced sequentially into the bag.

4. A blast protection structure according to any preceding claim, at least some of the bags are divided into internal chambers one above the other, with the lowermost chamber having a reinforcement layer.

5. A blast protection structure according to Claim 4, wherein the reinforcement layers are Kevlar ®.

6. A blast protection structure according to Claim 4 or Claim 5, wherein the uppermost chamber has an external non-slip coating.

7. A blast protection structure according to any preceding claim, wherein the flexible bags are formed of a drop stitch material.

8. A blast protection structure according to any

preceding claim, wherein the flexible bags have tongues and grooves or rebates to enable adjacent flexible bags to interlock or to have some degree of interengagement.

9. A blast protection structure according to any preceding claim, wherein flexible bags are used in conjunction with rigid bags to provide blast protection.

10. A blast protection structure according to any preceding claim, wherein flexible bags are assembled in layers to form a dome to form an explosion containment structure.

11. A blast protection structure according to any of Claims 1 to 9, wherein flexible bags are linked to one another to form a linear structure.

12. A blast protection structure according to Claim 11, wherein the linear structure forms a pathway over which persons or vehicles may travel.

13. A blast protection structure substantially as described herein with reference to and as illustrated in the accompanying figures.

Application No: GB 0205570.5
Claims searched: 1-13
Examiner: Dr. Lyndon Ellis
Date of search: 14 August 2002

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.T): A5A A23, A37
E1D DF115
E1H HJA
F3C CPK

Int Cl (Ed.7): E02B, E04B, F42D

Other: Online: EPODOC, WPI, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2335259 A	(Parkes) Whole document, noting page 4, lines 27-33	1-3, 9-11
A	GB 2326428 A	(Frost)	-
X	GB 2314614 A	(Parkes) Whole document	1-3, 9, 11
X	DE 19945108 A1	(Lloyds-Montan) Whole document	1 at least

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.